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Choosing the Size of Suberkrub Trawl Board to Suit a Pelagic-Type Four-Panel Trawl.

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Description of Suberkrub Trawl Boards

Suberkrub trawl boards are one of the most common types used with pelagic or semi-pelagic nets. A typical design is shown in Figure 1. Normally their height is 2 to 2.5 times their length. This ratio of height to length is called the aspect ratio. The ratio of the depth of the curve to the chord length of the trawl board is taken as a measure of curvature and is known as the camber. Suberkrub trawl boards have a camber (usually expressed as a percentage) in the range from 5 to 15%, commonly 10%. The aspect ratio and camber of this design are the features which make them so much more efficient than, for example standard flat otterboards.

A description of the practical operation and rigging of these trawl boards was given by Ferro (1980).

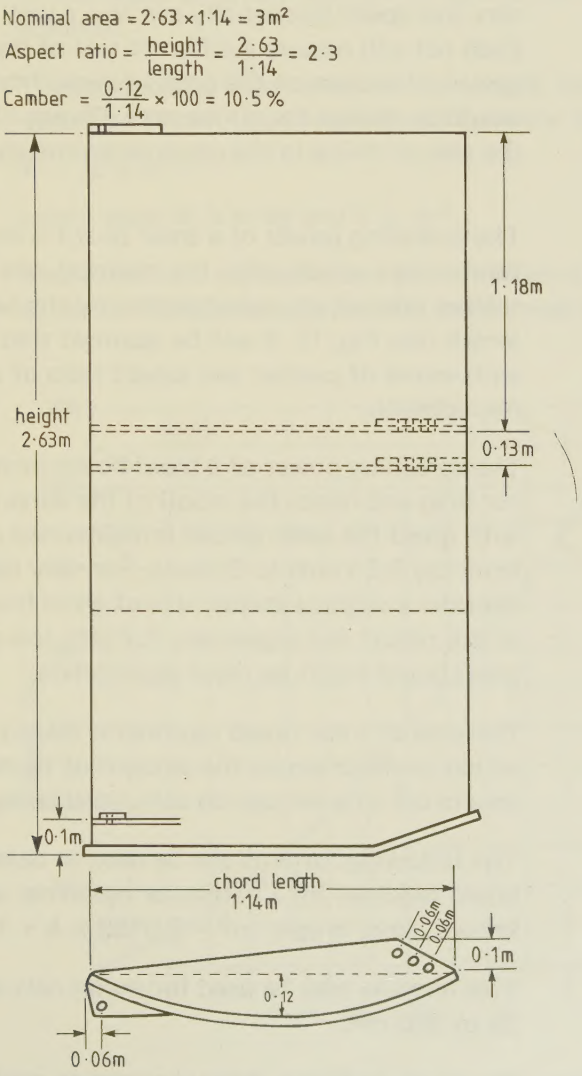


Figure 1. Basic dimensions and features of a Suberkrub trawl board (starboard board shown).

The Consequences of the Incorrect Choice of Size

The size of Suberkrub trawl board which is chosen for a particular net will have a significant effect on the performance of the gear as a whole. Most pelagic-type four-panel nets are designed to have roughly square mouths – that is, the headline and footrope are approximately the same length as the sidelines. The weights on the footrope and on the sweeps determine the vertical mouth opening while the size of the trawl boards determines the horizontal spread of the net mouth. If incorrect weights or trawl boards are used the net mouth will not be square and the net itself may be distorted with areas of slack or strained netting. These features can cause net damage or fish escape.

The use of too large doors will overspread and distort the net, reduce the height of the headline above the footrope, increase fuel consumption, create unnecessary handling problems and increase the capital cost of the gear. Too small trawl boards, however, will underspread the gear, cause excessive headline height and be subject to instability particularly on shooting, which may result in twists in the sweeps or which makes it easier for the gear to close completely and the trawl boards to lock together. Furthermore the manoeuvrability of the gear in the water column (achieved by changing speed) may be reduced.

In a number of references trawl board size has been related to vessel horsepower. This can be a very misleading practice because one vessel can tow a wide range of sizes of net, depending on the towing speed to be used. To put it another way, an engine of a particular power can tow a very large net at a very low speed but equally can tow a very small net at a very high speed. Each net will require a different size of trawl board to achieve the correct spread. If chosen on the basis of vessel horsepower, however, the same size would be chosen for all the nets. Choice of trawl board size by reference to the area of twine in the net is recommended.

Calculation of the Correct Area of Suberkrub Trawl Board

The spreading power of a trawl board is determined by its design (the camber and aspect ratio, for instance), the speed at which it is towed and the surface area which is represented by the height multiplied by the chord length (see Fig. 1). It will be assumed that the trawl board will be designed with values of camber and aspect ratio of approximately 10% and 2.25 respectively.

The spreading power of a trawl board increases with speed, but because the net drag and hence the inpull of the wires on the trawl board also increase with speed the same spread is maintained over quite a wide range of speeds from say 2.5 knots to 5 knots. For very high speeds it might be necessary to consider a slightly smaller size of trawl board than that given by the formula in this report and conversely for very low speeds a slightly larger size of trawl board might be more appropriate.

The area of trawl board required is mainly determined by the size of net, which in effect means the amount of twine in the net. The 'nominal' twine area in m^2 of a net can be calculated using the method of Ferro (1981).

The following formula can be used to determine the area of Suberkrub trawl board required for a particular nylon net whose twine area, A, in m^2 is known. Door area in $m^2 = 0.0152 \times A + 1.23$.

This formula may be used for nylon nets with twine areas in the range 25 to 350 m^2.

The graph in Figure 2 may be used to read off the trawl board area on the vertical axis given the twine area on the horizontal axis in appropriate units.

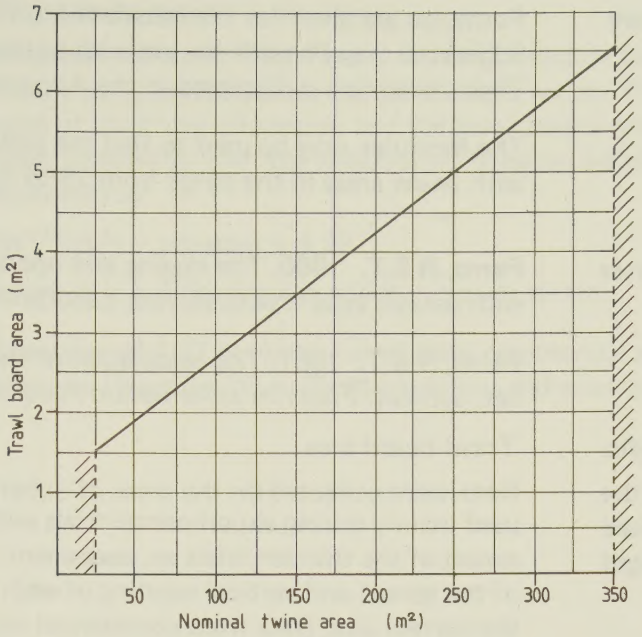


Figure 2. Determination of trawl board area in square metres from nominal twine area of a nylon four panel net in square metres.

Calculation of the Correct Weight in air of Suberkrub Trawl Board

Some careful consideration should also be given to the weight of the trawl boards because it affects the capital cost, the stability on shooting, the ease of handling on deck and, to some extent, the gear performance eg in terms of the depth at which the gear fishes and the manoeuvrability in the water column.

The weight of a trawl board whose area, B, has been found from the method described above may be calculated from the formula

$W = 75 \times B^{3/2}$

where again W is in kg and B in m^2.

This formula is expressed as a graph in Figure 3 so that the area can be read in on the horizontal axis and the weight read off the vertical axis.

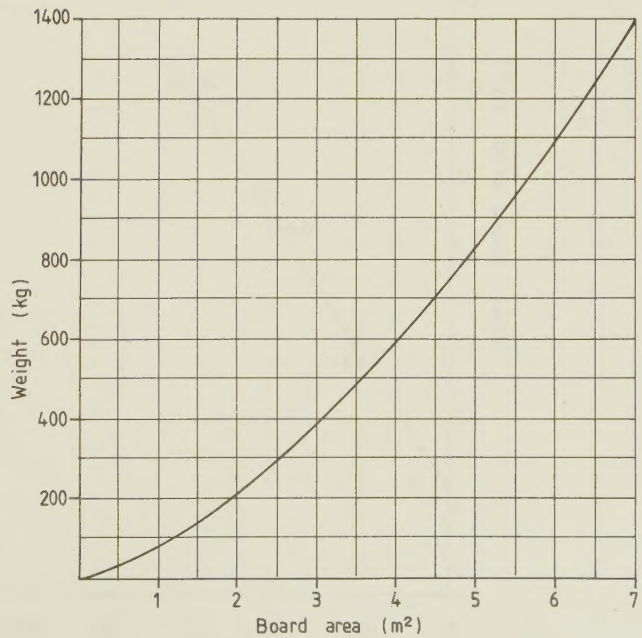


Figure 3. Determination of trawl board weight in kilogrammes from trawl board area in square metres for Suberkrub type only.

Summary

Formulae are given for the calculation of the area and weight in air of Suberkrub trawl boards for use with nylon pelagic type four panel nets. Their derivation is discussed in the Appendix.

The formulae may be used to find the size of trawl boards suitable for nets with twine areas in the range from 25 to 350 m^2.

References

Ferro, R.S.T. 1980. The rigging and operation of Suberkrub doors for use with pelagic-type trawls. Marine Laboratory Working Paper (80/20), 6 pp.

Ferro, R.S.T. 1981. The calculation of the 'nominal' twine area of a trawl net. *Scottish Fisheries Information Pamphlet* (5), 6pp.

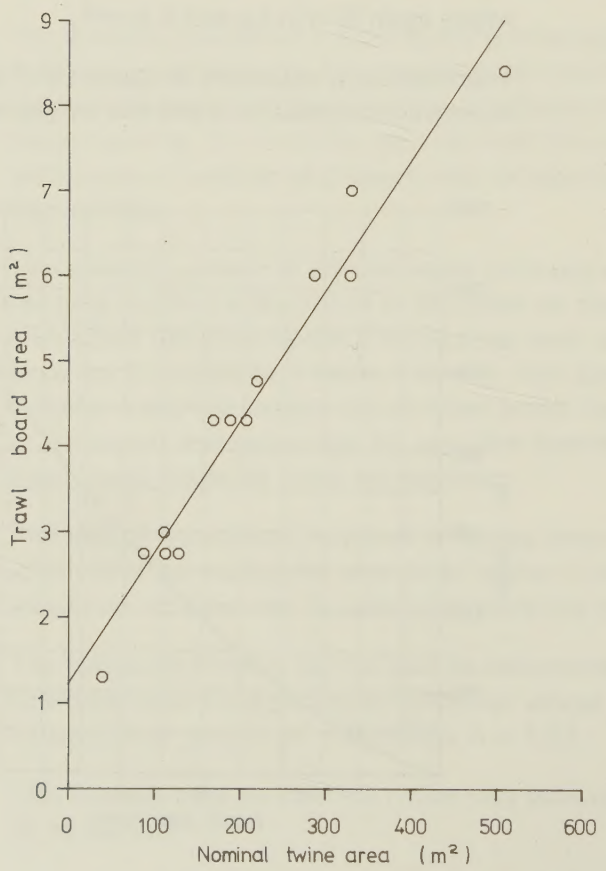
Appendix

Trawl board area

Derivation of the ormulae for trawl board area and weight

Data were collected on the areas of Suberkrub trawl boards which had been used mainly during experimental trials with nets of known twine area. In eleven of the thirteen trials an assessment could be made from measurements of the spread and vertical opening of each net whether the trawl boards were the correct size. Data from commercial vessels were not used because no such assessment could be made.

The gears were used with trawl boards ranging from 1.3 m^2 to 8.4 m^2. The nets were all of four-panel nylon construction with headline length to sideline length ratio ranging from 1 to 1.16, ie they were all approximately square nets. The cutting rate used along the selvedges was 1N4B for the majority of the nets although in some designs a shallow taper of 1N2B was used. Appendix Figure 1 shows a plot of trawl board area against twine area. A linear regression through the points is shown and the equation of this line has been taken as the formula quoted earlier. Until additional points are found at the higher twine areas above 350 m^2 the application of this formula should be restricted to twine areas between 25 and 350 m^2.



Appendix Figure 1. Data from full scale gears of trawl board area in square metres against nominal twine area of net in square metres.

Trawl board weight in air

Whatever the size of trawl board its weight should always be related approximately to its area. Because the trawl board weight W is proportional to the cube of the linear dimension and the trawl board area B to the square of the linear dimension then the relationship between weight and area may be expressed as

$(W^{1/3}/B^{1/2})$ = constant = 4.22

where W is in kilogrammes and B in square metres.

The value of 4.22 has been found from commercial and research practice to give trawl boards with sufficient stability and strength.

FERRO, R.S.T. 539.2.081.112.001.2:532.5.013.12

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The correct matching of trawl gear components, such as trawl boards, to nets is an important aspect of design, to ensure that the gear takes up the design shape when fishing. Formulae are given for the calculation of the area and weight in air of Suberkrub trawl boards to match nylon pelagic-type four-panel nets. The formulae are based on the 'nominal' twine area of the net which is representative of its hydrodynamic drag.

Key words: Trawl, Net, Trawl Board.
Twine, Design, Calculations, Drag.

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